Abstract

Understanding dynamics is important in controlling mechanical systems in general. In this talk, I will talk about a remarkable dynamic memory effect of viscous damping friction in the motion of underactuated mechanical systems. If an underactuated mechanical system without any energy storing element but with Abelian symmetry under influence of damping friction gets deviated initially from rest by a control force that disappears in the end, then the system asymptotically recovers its way back to its starting state as if it remembers the initial configuration. This phenomenon, which is called damping-induced self-recovery, turns out to be a general phenomenon that occurs over a wide range of the magnitude of damping or viscosity, including the momentum conservation principle as an extreme case of damping-induced self-recovery with zero damping in which case recovery takes an infinite amount of time, i.e., never takes place, and the kinematic reversibility of low-Reynolds number fluid flows as the other extreme case with infinitely large viscosity in which case recovery is instantaneous. I will present both theory and experiments on this remarkable phenomenon. This talk is accessible to undergraduate students.

Short biography

Dong Eui Chang received a BS degree in control & instrumentation engineering, summa cum laude, and an MS degree in electrical engineering both from Seoul National University and a PhD in control & dynamical systems from Caltech. He is currently an associate professor in the school of electrical engineering at KAIST. Before he joined KAIST, he was an associate professor in the department of applied mathematics at the University of Waterloo, Canada. His research interests lie in control, mechanics, and of course machine learning.